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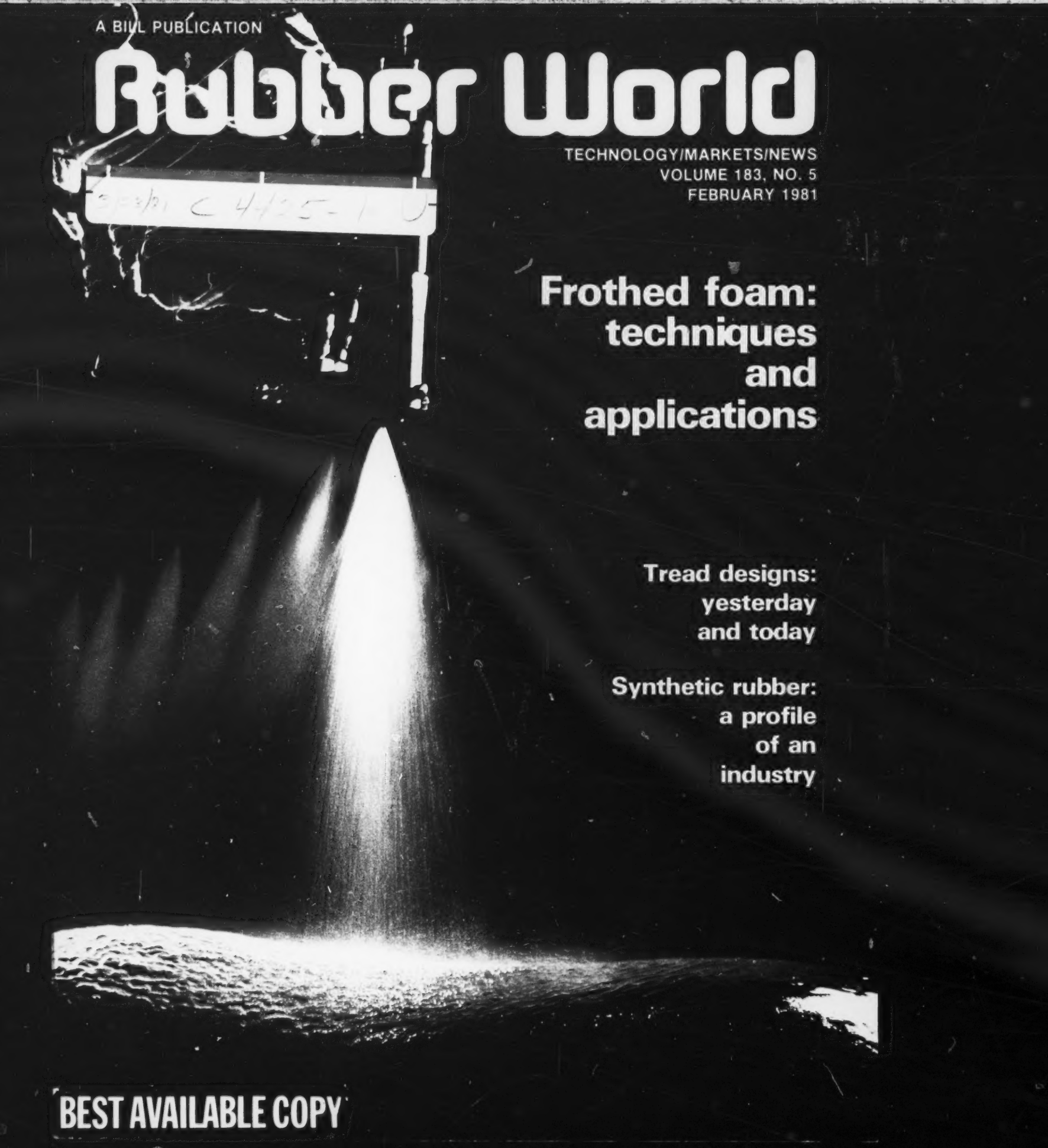

Frothed foam: techniques and applications

Tread designs: yesterday and today

Synthetic rubber: a profile of an industry

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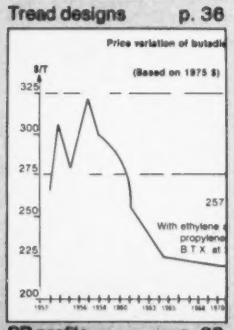

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Spray application of rigid urethane foam on substrate creates an unusual visual pattern. Photo: courtesy of Witco Chemical Corp., Isocyanate Products Div., Wilmington, Del.

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Late News

Armstrong buying controlling interest in Copolymer Rubber

Armstrong has reached an agreement in principle with Sears, Roebuck to acquire two-thirds of Sears' interest in Copolymer Rubber & Chemical. Armstrong presently owns a 50% interest in Copolymer while Sears and Gates Rubber each have 25%. The transaction between Armstrong and Sears will result in increasing Armstrong's share to 66-⅔%. Sears will receive approximately 200,000 shares of Armstrong common stock. A Sears subsidiary, Allstate Insurance, owns 168,400 shares, or 9.9% of the outstanding Armstrong common stock. Sears holdings in Armstrong will increase to over 21%. Copolymer has two plants in the Baton Rouge, LA, area where it produces synthetic rubber compounds and derivatives. Gates has indicated that it is negotiating with Sears to acquire the remaining one-third of Sears' interest in Copolymer to increase Gates' interest to 33-⅓%.

Neutrality letter of 1979 applies to Firestone's Okla. Dayton Tire plant

The United Rubber Workers has announced that organizing neutrality does apply to Firestone Tire and Rubber's Oklahoma City Dayton Tire facility. Arbitrator Edwin R. Teple ruled that the neutrality letter of July 14, 1979 applies to that plant. According to URW International President Peter Bommarito, this is a major victory for the union. "The only tragedy is that it was apparent to us that the neutrality letter of 1979 did apply," he said. "It's a shame that this didn't take effect until now." Firestone had adopted a "no strike/me too" position in the 1979 negotiations. But after BFGoodrich set the pattern, which included a URW-negotiated organizing neutrality letter, it was the URW's position that this applied to Dayton Tire in Oklahoma as well.

The neutrality letter applies to unorganized tire facilities. Under it, Firestone agreed to "neither discourage nor encourage the union efforts to organize these employees, but will observe a posture of strict neutrality in these matters." It also said, The union would "conduct itself in such organizing campaigns in a constructive manner which does not misrepresent to employees the facts and circumstances surrounding their employment."

Bommarito said, "It was our intention to begin an active campaign in Oklahoma City sometime in January regardless of the outcome of this case. We are now delighted to be able to do so under neutrality." Since 1970, the URW has conducted a number of close NLRB elections, including one with a tie vote, at this tire plant. (Tie votes count as wins for the company.) On December 19, when the neutrality was supposed to have been in effect, the vote was URW 557, the company 588.

Commerce Dept. predicts real growth of 6% for rubber industry

Shipments of rubber and rubber products are expected to increase 16% this year to $22 billion the Commerce Department forecast. Adjusted for inflation, the gain would be 6% compared with a drop of 15% in 1980. Commerce's Bureau of Industrial Economics said the rubber industry should grow at 1% to 2% in real terms through 1985. The BIE said "the expected growth in car sales, increased use of hose to transport petroleum and natural gas, and development of U.S. coal reserves, which will require substantial quantities of hose and belting, offer long term optimism for the industry."

General Tire profits decline; T.F. O'Neill resigns board position

Slumping automobile production and unfavorable economic conditions were cited by General Tire as major causes of a 49% decline in net income for 1980. General posted sales of $2.2 billion with a new income of $40.7 million. The company earned $80.1 million in 1979 on sales of $2.29 billion. Fourth quarter figures however, showed an income increase of 101% over the previous year on a sales increase of 4.1%. The company also announced that board chairman T.F. O'Neill would not run for re-election. The board anticipates that M.G. O'Neill, president of General Tire, will assume the additional duties. T.F. O'Neill will stand for re-election as a director and expects to remain as chairman and CEO of RKO General.

RMA MONTHLY TIRE REPORT (Through October)

Passenger Tires	Cum. 1980	Cum. 1979
Shipments		
Original Equipment	29,685,919	42,366,040
Replacement	91,618,670	106,902,285
Export	3,427,790	3,251,382
Total	124,732,379	152,519,707
Production	109,331,899	146,322,620
Truck & Bus		
Shipments		
Original Equipment	4,458,315	8,798,028
Replacement	20,386,677	24,644,167
Export	1,254,541	931,205
Total	26,099,533	34,373,400
Production	23,723,607	33,544,869

Tractor Implement Tires		
Shipments		
Original Equipment	1,361,965	1,832,189
Replacement	2,233,039	2,760,993
Export	183,081	168,669
Total	3,778,085	4,761,851
Production	3,582,143	4,760,339
Tread Rubber		
(Figures in 000 lbs.)		
Shipments		
Domestic	346,464	377,597
Export	38,952	33,960
Total	385,416	411,557
Production	388,039	415,166

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Synthetic rubber: profile of an industry

by David L. Schultz, Editor

Between 1945 and 1973, synthetic rubber continued to be produced in increasing quantities to gain a predominant position in the world market. Integration by petrochemical producers and tire manufacturers became a prevalent characteristic of the production process. Consumption of rubber increased dramatically during the period. The extremely rapid growth of motor vehicle use in Western Europe and Japan, coupled with the continuous expansion of automotive production in the U.S. created a strong and steady demand for elastomers. Non-automotive elastomer demand also increased rapidly: between 1948 and 1973, total consumption of elastomers increased 6.3% per year.

The oil crisis and subsequent sharp rise in crude oil prices beginning in 1973, however, severely impacted the synthetic rubber industry — an industry which depends so heavily on petrochemical feedstocks. In 1978-1979, the price of crude oil again increased sharply in real terms, bringing the cumulative increase since 1973 to more than 400%.

These crude oil price increases have affected production costs of SR more than NR. The production cost of SR depends heavily (as much as 70% of the total) on the costs of chemical feedstocks and energy inputs such as steam and electricity. Between 1973 and 1975, the cost of the basic chemical monomers used in synthetic rubber production — styrene, butadiene and isoprene — and of other chemical and energy inputs more than doubled.

Lower demand

Changes in consumer preferences accompanied by significant technological innovations are contributing factors in a slowdown of world elastomer demand. Most recent estimates peg world demand for elastomers at an average growth rate of 5% to 5.5% per year to 1990 — approximately 1% below the historical rate. But even this estimate may prove to be overoptimistic. The U.S. Department of Commerce, for example, sees a real annual growth rate in the synthetic rubber industry of 1% to 2% to 1985 (*RW*, Jan. 1981, p. 23). It would appear that the industry is facing in particular greater uncertainties concerning the availability and pricing of chemical feedstocks in addition to mounting pressure over environmental and health issues.

Cost and availability of feedstocks are key worries in the synthetic rubber industry. For example, just as industry analysts and producers forecast, ethylene prices for the first quarter of 1981 have settled to a high 24.5¢ per pound. And industry sources agree that the new, higher price will hold through the remainder of the quarter. Several ethylene analysts have stated that they will not risk forecasting a price for olefins beyond the first quarter, but agree in anticipating a continued escalation in ethylene prices as a result of the rising costs of all feedstocks.

Another concern is that worsening business conditions in the U.S. will result in substantial discounting which will bring additional instability and uncertainty to an already iffy situation. While prices have risen strongly, there is some question as to the durability and net financial effect of the increases. Most officially-announced increases are in the 5% to 15% range with a cluster from 8% to 10%. But world oil prices have already outstripped these percentages, and further increases are anticipated for the spring.

SR types

Seven major types of SR dominate the market in terms of tonnage, accounting for approximately 98% of all SR and 66% of all rubber consumed. Styrene-butadiene (SBR), polybutadiene (BR) and polyisoprene (IR) are commonly classified as the general-purpose type SR. Ethylene-propylene rubbers (EPM/EPDM), polychloroprene rubber (CR), nitrile rubber (NBR) and butyl rubber (IIR) are generally classified as specialty rubbers.

Historically, these seven types of

World Rubber Consumption, by Kind of Rubber, 1977

Kind of rubber	Thousands of metric tons	Percentage of synthetic rubber	Percentage of total rubber
Synthetic rubber			
Styrene-butadiene (SBR)	3,328	58.3	38.3
Polybutadiene (BR)	895	15.7	10.3
Polyisoprene (IR)	208	3.6	2.4
Ethylene-propylene (EPM-EPDM)	290	5.1	3.3
Polychloroprene (CR)	318	5.6	3.7
Butyl (IIR)	386	6.8	4.4
Nitrile (NBR)	190	3.3	2.2
Other synthetic	91	1.6	1.1
Total	5,706	100.0	65.7
Natural rubber	2,984	—	34.3
Total rubber	8,690	—	100.0

Note: Excluding centrally planned economies
— Not applicable
Sources: International Institute of Synthetic Rubber Producers (IISRP), private communication; and International Rubber Study Group, *Statistical Bulletin.*

Rubber growth rates (%/yr)

	US		W. Eur		Far East	
	80/85	85/90	80/85	85/90	80/85	85/90
SBR	2.5	2.0	1.5	1.0	5.0	5.0
BR	3.5	2.0	3.5	2.5	5.5	4.5
NBR	3.0	2.0	2.5	3.0	4.0	5.0
CR	2.5	2.0	1.5	2.0	2.5	2.5
Butadiene	3.0	2.5	2.5	2.0	5.0	5.0

Source: IISRP

US synthetic rubber production, 1980 (%)

SBR	59.0
Isoprene	3.0
Nitrile	3.3
Neoprene	5.2
Butyl	5.5
Ethylene-propylene	6.0
Polybutadiene	18.0

World synthetic rubber production (000 m tons)

	1978	%
US	2,473.4	28.4
Japan	1,028.9	11.8
France	491.5	5.6
W. Germany	407.0	4.7
UK	293.7	3.4
Italy	250.0	2.9
Canada	248.3	2.8
Netherlands	222.8	2.5
Others	3,304.4	37.9
Total	8,720.0	100.0

Source: Syndicat National du Caoutchouc et des Plastiques (France)

SR can be divided into two main classes: first-generation synthetics (styrene-butadiene, polychloroprene, butyl and nitrile) developed before WW II and second-generation or stereoregular rubbers (polybutadiene, polyisoprene and ethylene-propylene) developed in the 1950s.

In recent years, however, production of SR has declined. For example, total U.S. production of SR in 1978 amounted to 5,761 million pounds, a decrease of 0.9% from that produced in 1977. Total sales of elastomers in 1978 amounted to 3,640 million pounds, a decrease of 12.9%.[1]

In terms of tonnage, styrene-butadiene rubber (SBR) is the single most important type of rubber in the world. It represents 38% of total rubber consumption outside the centrally-planned economies. Its share in total synthetic rubber consumption is even higher, about 58%. Worldwide, more than 60% of all SBR is consumed in tires. Other uses include footwear, conveyor belts, cable insulation, hose, battery containers and adhesives. But here, as with numerous other sectors of the synthetic industry, the monomer supply is expected to grow tight through 1985. Demand and growth projections for styrene — 6,900 million pounds (1980); 7,000 million pounds (1981); and 8,500 million pounds (1985) coupled with a growth rate of a projected 4.3% per year through 1985 — if they are to prove accurate, means that the industry will need a new "world-scale" plant every three years as the decade progresses, an unlikely eventuality.

Consequently, production of SBR is expected to level off or decline. In addition to increasingly-tight feedstock supplies, another problem is the buildup of overseas capacity and the consequent loss of export markets. Whereas exports accounted for 15.2% of all U.S. production of SBR in 1963, their share fell to 6.0% in 1978.

Polybutadiene rubber (BR), the second major SR type, accounted in 1977 for 15.7% of total SR consumption outside the centrally-planned economies and 10.3% of total rubber consumption. One characteristic of BR is that it is seldom used alone. Normally it is blended with SBR or NR. Until the mid-1960's, BR was priced above SBR-1500. But from the mid-1960's onwards, BR prices have been approximating those of SBR.

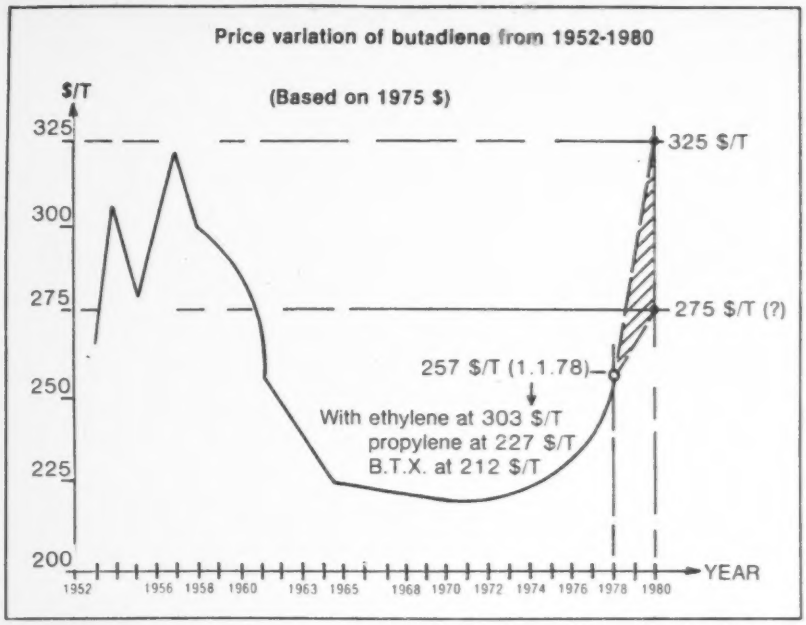
"Technological innovations in synthetic rubber production seem to have run much of their course."

Polyisoprene (IR) is the closest synthetic to NR. But despite its excellent properties and high manufacturers' expectations of its market potential, IR has found it difficult to compete with NR on a relative price basis. IR is costly to produce since both the derivation of the isoprene monomer and the polymerization process are technically more complex and costly than those of SBR. Market penetration of IR has been slow over the past ten years. For example, in 1977, IR accounted for only 3.6% of all SR and 2.4% of all rubber consumed outside the centrally-planned economies.

When ethylene-propylene rubbers (EPM and EPDM) were introduced a decade ago, they were widely touted as another SBR or general-purpose rubber. However, they have not yet been accepted in tire applications in any great quantity. The low cost of the basic monomers, the ability of EPM to accept high loadings of oil, and its processing ease were thought to be strong assets. But EPM was difficult to vulcanize; and the solution to this problem — the addition of diene, a costly material — counteracted much of the initial relative cost advantage and prevented the modified EPM from entering the tire market. EPDM is now used mostly in automotive parts other than tires, where resistance to ozone and weather is required.

(continued on page 32)

[1]U.S. International Trade Commission, *Synthetic Organic Chemicals*, 1979, USITC Publication 1001, Washington, D.C.



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Polychloroprene (CR), butyl rubber (IIR) and nitrile rubber (NBR) are the three remaining important types of SR from the standpoint of world consumption. All are expensive on a relative basis and are used only in products which require their special technical properties. Other SR's include a large number of specialty rubbers which meet specific needs of particular manufactured products. There are approximately 170 distinct kinds of specialty rubbers which can be classified as castable elastomers such as urethane, silicones and polysulfides; thermoplastic rubbers; and powdered elastomers.

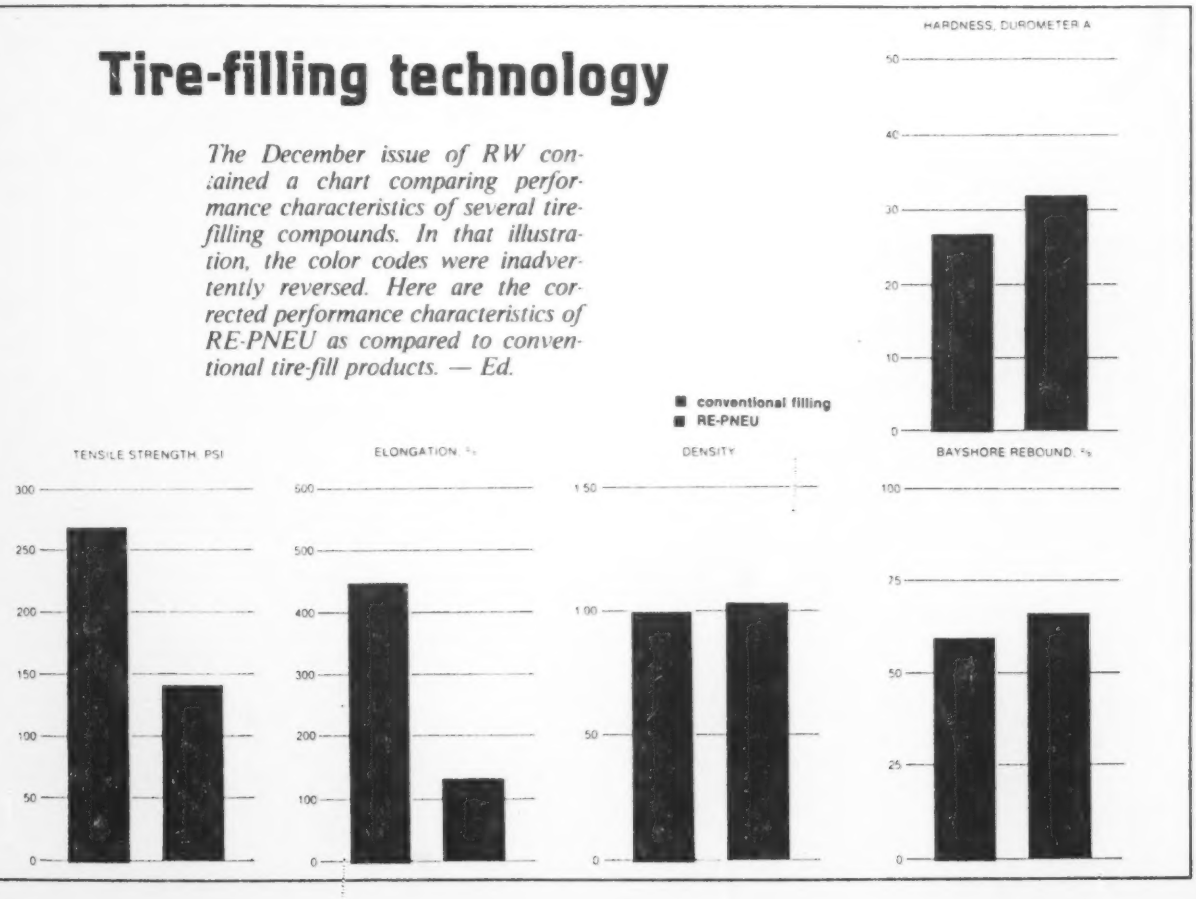
Maturing industry?

According to an extensive report compiled by the World Bank, technological innovations in synthetic rubber production, as well as in economies of scale, seem to have run much of their course. Their future effect on the cost and price of the traditional kinds of SR is likely to be much less strong than in the 1950's and 1960's. "After twenty-five years of unrestrained expansion," the report notes, "the synthetic rubber industry is reaching a stage where emphasis is likely to be put on rationalization, consolidation and more planned growth."

Apart from the economic constraint to further rapid growth posed by high and still-rising real energy costs, the synthetic rubber industry — as noted above — will have to face uncertainties concerning the availability and price of chemical feedstocks, mounting pressures over environmental issues related to the production of chemicals, and some critical questions concerning the potential health hazards of prolonged exposure of workers to certain basic chemicals.

Tire-filling technology

The December issue of RW contained a chart comparing performance characteristics of several tire-filling compounds. In that illustration, the color codes were inadvertently reversed. Here are the corrected performance characteristics of RE-PNEU as compared to conventional tire-fill products. — Ed.



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